REMARKS

Claims 2-14 are all the claims presently pending in the application. Claims 2 and 4 are amended to more clearly define the invention and claims 15-18 are added. Claims 2 and 5 are independent.

These amendments are made only to more particularly point out the invention for the Examiner and not for narrowing the scope of the claims or for any reason related to a statutory requirement for patentability.

Applicants also note that, notwithstanding any claim amendments herein or later during prosecution, Applicants' intent is to encompass equivalents of all claim elements.

Applicants gratefully acknowledge that claims 3-4 and 7-13 would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. However, Applicants respectfully submit that all of the claims are allowable.

Claims 2, 5-6, and 14 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over the Church et al. reference in view of the Suganami et al. reference.

This rejection is respectfully traversed in the following discussion.

I. THE CLAIMED INVENTION

An exemplary embodiment of the claimed invention, as recited by, for example, independent claim 5, is directed to an electronic controller for a variable nozzle control apparatus that includes an angle sensor that detects a rotation angle of an output shaft, which drives a vane of a variable nozzle, and that outputs an actual angle signal, an electronic control circuit that receives a vane opening signal from an engine electronic control unit and

that provides an output signal based upon the vane opening signal and the actual angle signal, and a driver that drives the output shaft based upon the output signal.

Conventional variable nozzle controllers include a duty solenoid valve that uses a pressure chamber and a pressure actuator to vary the vane opening of a turbocharger. The engine electronic control unit receives a boost signal as feedback from the turbocharger and controls the duty solenoid valve using (among other signals) the boost signal.

These conventional controllers have several problems, including a misarrangement of the precision of the duty solenoid valve and the boost signal, a temperature drift, and linear interpolation computing errors. Further, these controllers have not been able to carry out control to an optimum value and the load hysteresis through the system is quite large and, therefore, the system has very poor resolution. Additionally, theses controllers include a control line to the duty solenoid valve that is susceptible to electro-magnetic noise and/or interference.

In stark contrast to these conventional controllers, the present invention provides a controller having an electronic control circuit that receives an opening indication information of the vane from the engine electronic control unit. In this manner, the present invention, reduces the load of the software of the engine electronic control unit, eliminates various hoses, forms a control signal line that does not require noise countermeasures, mounts the electronic controller on the turbocharger to reduce the overall size, decides whether the vane opening is correct by performing a comparison, and enhances resolution of the control over the vane opening. (Page 8, line 15 - page 9, line 9).

II. THE PRIOR ART REJECTION

The Examiner alleges that the Suganami et al. reference would have been combined with the Church et al. reference to form the claimed invention. Applicants submit, however, that these references would not have been combined and even if combined, the combination would not teach or suggest each and every element of the claimed invention.

None of the applied references teaches or suggests the features of independent claims 1 and 5 including: 1) an engine electronic control unit that outputs an opening indication information of a vane (claim 1); and 2) an electronic control actuator that includes an electronic control circuit section that receives the opening indication information of the vane from the engine electronic control unit (claims 1 and 5). As explained above, these features are important for reducing the load of the software of the engine electronic control unit, eliminating various hoses, forming a control signal line that does not require noise countermeasures, mounting the electronic controller on the turbo-charger to reduce the overall size, deciding whether the vane opening is correct by performing a comparison, and enhancing resolution of the control over the vane opening.

Firstly, Applicants note that the Church et al. reference clearly does not teach or suggest an electronic control actuator.

Indeed, Examiner Trieu admits that the Church et al. reference does not disclose an electronic control actuator. In particular, with respect to the Church et al. reference, Examiner Trieu admits that the electronic control actuator is "Not Shown".

In other words, since the electronic control actuator is "Not shown" by the Church et al. reference, the Church et al. reference clearly does not teach or suggest an electronic control actuator.

Therefore, all of the closed loop control system 60 that is illustrated by Figure 2 of the Church et al. reference is clearly incorporated into an engine electronic control unit. In particular, all of control logic 62, control logic 67, and control logic 54 are incorporated into an engine electronic control unit. Thus, the Church et al. reference does not teach or suggest an electronic control actuator.

Further, the Church et al. reference does not teach or suggest the features of the present invention including: 1) an engine electronic control unit that outputs an opening indication information of a vane (claim 1); and 2) an electronic control actuator that includes an electronic control circuit section that receives the opening indication information of the vane from the engine electronic control unit (claims 1 and 5).

The Church et al. reference discloses an engine electronic control unit that receives a position of a piston in a linear actuator as sensed by a cylinder integrated position sensor (col. 5, line 48 - col. 6, line 9) "which is indicative of current turbocharger geometry." (Id.).

The engine electronic control unit then compares that piston position (i.e. current turbocharger geometry) with a "desired turbocharger geometry" using the control logic 67. (Col. 6, lines 10-22).

In order for a proper comparison to be performed by the control logic 67, the "desired turbocharger geometry" must be in the same form as the current turbocharger geometry. In other words, the "desired turbocharger geometry" must be in the form of a desired piston position.

The engine electronic control unit provides a pulse width modulated control signal to a valve 66 which, in turn controls, the position of the piston within the cylinder of the linear actuator. (Col. 6, lines 3 - 10 and 35 - 46).

Therefore, the engine control unit that is disclosed by the Church et al. reference clearly discloses outputting a pulse width modulated control signal which is a valve control signal and clearly does not teach or suggest the features of the present invention including: 1) an engine electronic control unit that outputs an opening indication information of a vane (claim 1); and 2) an electronic control actuator that includes an electronic control circuit section that receives the opening indication information of the vane from the engine electronic control unit (claims 1 and 5).

The Suganami et al. reference does not remedy the deficiencies of the Church et al. reference.

Rather, the Suganami et al. reference discloses a position sensor 150 attached to the output shaft of a motor 130. Thus, the Suganami et al. reference discloses a position sensor that "measures the angle of rotation of the output shaft of the motor" (Emphasis added; [0058]).

Further, the Suganami et al. reference discloses a control circuit 160 that "compares measured position data provided by the position sensor included in the actuator, and desired position data represented by a signal received from a (sic) engine control unit (ECU) 300 included in the internal combustion engine, and controls the actuator 100 according to the difference between the measured and the desired position data."

In order for the control circuit 160 to make a meaningful comparison between the measured and the desired position data, the format of that data must be the same. Therefore, since the position sensor "measures the angle of rotation of the output shaft of the motor" the desired position data must be in the form of a desired angle of rotation of the output shaft of the motor. Thus, the engine electronic control unit 300 must provide a desired angle of

rotation of the output shaft of the motor.

Therefore, the Suganami et al. reference clearly does not teach or suggest the features of the claimed invention including: 1) an engine electronic control unit that outputs an opening indication information of a vane (claim 1); and 2) an electronic control actuator that includes an electronic control circuit section that receives the opening indication information of the vane from the engine electronic control unit (claims 1 and 5).

Therefore, the Suganami et al. reference does not remedy the deficiencies of the Church et al. reference.

Further, Applicant submits that these references would not have been combined as alleged by the Examiner.

Indeed, the Examiner's alleged motivation is completely inapplicable to the teachings of the applied references.

In particular, the Examiner alleges that it would have been obvious to replace the cylinder integrated position sensor that is disclosed by the Church et al. reference with an angle sensor as disclosed by the Suganami et al. reference because such a modification "would have prevented the vibrations of the output shaft from being transmitted to the sensor." (Page 4 of the Office Action).

The Church et al. reference does not teach or suggest any output shaft at all. Therefore, the device that is disclosed by the Church et al. reference does not suffer from "vibrations of the output shaft."

Although, the Examiner does not explain the source of the Examiner's alleged motivation (despite the requirements to do so set forth in the M.P.E.P.), Applicants have carefully reviewed the applied references in an attempt to discover the source of the

Examiner's alleged motivation.

Applicants' review of the Suganami et al. reference reveals that the Suganami et al. reference is concerned with the problem of vibrations of the output shaft being transmitted to the position sensor at [0002] - [0005] and explains that providing a position sensor to the output shaft of a motor addresses this problem [0008].

However, Applicants also note that the Suganami et al. reference explains that output shaft vibration are a problem for electronically controlled actuators that include a motor and a speed change mechanism as disclosed in, for example, EP-A No. 109088/1999.

Since, the Church et al. reference does not include an electronically controlled actuator which includes a motor and a speed change mechanism, the device disclosed by the Church et al. reference does not suffer from the problem of output shaft vibration.

Therefore, contrary to the Examiner's allegation, one of ordinary skill in the art would not have been motivated to substitute an angle position sensor on an output shaft of a motor as disclosed by the Suganami et al. reference for the cylinder integrated position sensor that is disclosed by the Church et al. reference because the Church et al. reference does not suffer from the problem of output shaft vibration.

Further, one of ordinary skill in the art would not have been motivated to refer to any one of the applied references in light of the teachings of the other because the references are directed to completely different and unrelated matters and problems.

Specifically, the Church et al. reference is concerned with addressing the problem of a slow response time which makes it difficult to precisely control a turbocharger (col. 1, line 61 - col. 2, line 5).

In stark contrast, the Suganami et al. reference is directed to the completely different

and unrelated problems of reduced vibration resistance and errors being introduced in measured positions due to an increase in the vibration of a position sensor in an electronically controlled actuator that includes a motor and a speed change mechanism. ([0002] - [0005]).

One of ordinary skill in the art who was concerned with addressing the problem of a slow response time which makes it difficult to precisely control a turbocharger as the Church et al. reference is concerned with solving would not have referred to the Suganami et al. reference because the Suganami et al. reference is concerned with the completely different and unrelated problem of reduced vibration resistance and errors being introduced in measured positions due to an increase in the vibration of a position sensor in an electronically controlled actuator that includes a motor and a speed change mechanism.

Indeed, as explained above, the Church et al. reference does not include any output shaft angular position sensor that might suffer from output shaft vibration.

Thus, the references would not have been combined.

Therefore, the Examiner is respectfully requested to withdraw the rejection of claims 2, 5-6, and 14.

III. FORMAL MATTERS AND CONCLUSION

In view of the foregoing amendments and remarks, Applicant respectfully submits that claims 2-18, all the claims presently pending in the Application, are patentably distinct over the prior art of record and are in condition for allowance. The Examiner is respectfully requested to pass the above application to issue at the earliest possible time.

Should the Examiner find the Application to be other than in condition for allowance, the Examiner is requested to contact the undersigned at the local telephone number listed

below to discuss any other changes deemed necessary in a telephonic or personal interview.

The Commissioner is hereby authorized to charge any deficiency in fees or to credit any overpayment in fees to Attorney's Deposit Account No. 50-0481.

Respectfully Submitted,

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